Nov. 3, 1953 C. L. MILTON, JR., ET AL 2,657,394

COSMETIC GLOVE

Filed Feb. 2, 1948

Fig. 1.

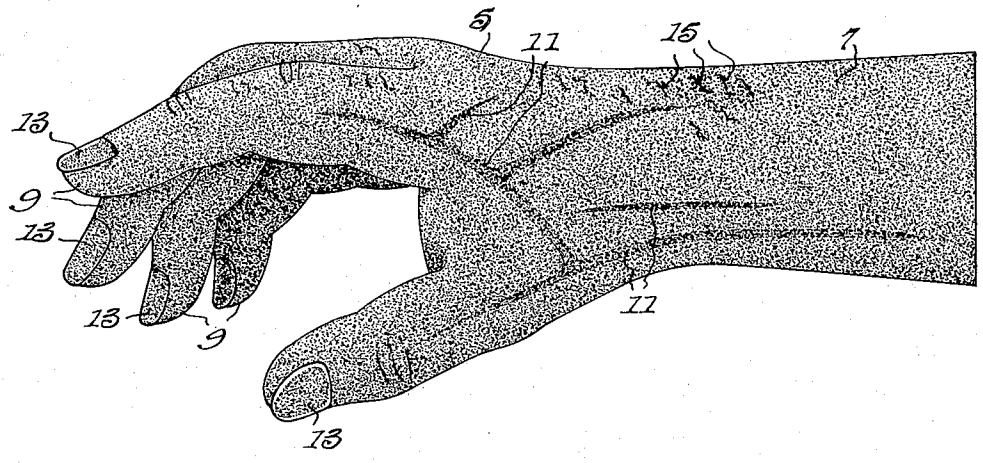


Fig. 2.

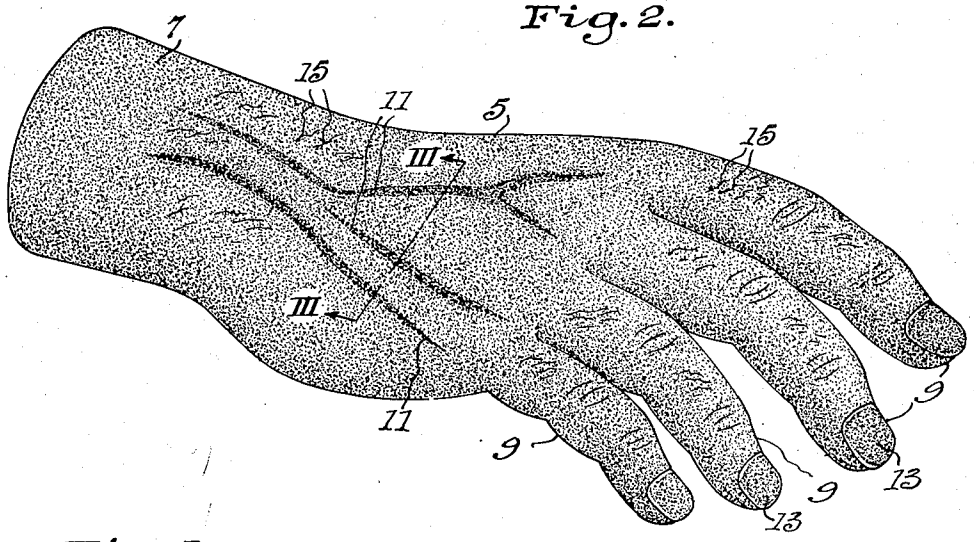
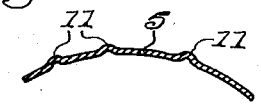


Fig. 3.



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Patented Nov. 3, 1953

2,657,394

UNITED STATES PATENT OFFICE

2,657,394

COSMETIC GLOVE

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Application February 2, 1948, Serial No. 5,717

5 Claims. (Cl. 3—12)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without payment to us of any royalty thereon.

The present invention relates to cosmetic gloves that are adapted to be fitted over and worn on artificial hands.

Cosmetic gloves as customarily employed as coverings for artificial hands are open to the objection of unnaturalness in appearance, showing immediately that the wearer has an artificial hand. The conventional glove of this type actually attracts attention to the fact that the wearer is an amputee; and the availability of a cosmetic glove which closely approximates the appearance of a natural hand so as to defy detection even on close inspection has been a long-wanted factor for assisting in uplifting and maintaining the morale of amputees having to rely on artificial hands. Such an accessory, however, has not been available or known prior to the present invention.

The present invention, therefore, has for one of its objects the provision of a cosmetic glove, which, when worn as a covering for a mechanical or prosthetic hand, is indistinguishable in appearance and in touch from a natural hand.

A further object of the invention is to provide a natural-appearing cosmetic glove of the above-indicated character which is cheap to manufacture and which is available to amputees at a very low cost.

A still further object of the invention is to provide a cosmetic glove for use on artificial hands which is indistinguishable in appearance from a natural hand, duplicating in great fidelity all lines, marking contours, as well as skin texture in the mating hand.

Other objects of the invention will become apparent as the description proceeds, and the features of novelty will be pointed out in particularity in the appended claims.

The factors leading to the successful realization of the objects of the invention are the method by which the improved cosmetic gloves of the invention are produced and the composition of the resinous material from which the gloves are produced.

The process of the present invention consists, in general, obtaining an impression of a hand, making a positive model in the impression, forming a negative mold from the said positive, casting the glove, and coloring the glove.

In carrying out the process of the invention, the first step is to obtain an impression of the

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hand of a subject which is to serve as a model. Numerous methods of obtaining such impressions are known, which may be employed in carrying out the process of the present invention. However, in carrying out the present invention, it is preferred to use an alginate impression compound such as those sold under the trade-names of "Zelex" or "Coe-loid," both of which are composed of sodium alginate, an inert filler such as clay, whiting, or the like, and dehydrated calcium sulphate. A cylindrical or elliptical cylinder or tray, which conveniently is truncated, is prepared. A non-rigid tray preferably is employed, such as one fashioned from thin sheet metal or screen and backed with a heavy sheet of vulcanized rubber or synthetic rubber. Into this tray is poured the impression compound, mixed with water containing phosphate ions, for example, tri-sodium phosphate, resulting in precipitation of a calcium phosphate in the impression compound. The hand of a subject which is to serve as a model is thrust into the liquid impression compound and allowed to remain there until the latter has hardened to a firm gel. The hand is loosened from the resulting impression by means of gentle muscular movements, water being poured down between the flesh and the impression, and with the aid of air introduced around the fingers and hand to prevent the creation of a vacuum, the model hand is withdrawn, leaving a cavity surrounded by a negative impression of the hand.

The impression compound employed must retain its consistency up to the boiling point of water. After the model hand has been removed, the impression is immersed in hot water in order to heat the gelled impression for the next step—which is the production of a positive from the negative impression in which all lines, markings and other characteristics in the model hand have been reproduced in full detail.

The impression when heated in the water bath is removed therefrom and drained, and while still hot into it is poured a resinous dispersion of the following preferred composition, the proportions being parts by weight:

Paste grade polyvinyl chloride-acetate copolymer	48
Tricresyl phosphate	26
Dibutyl phthalate	26
Polyethyl methacrylate	4

In preparing this dispersion, the polyethyl methacrylate (or polymethyl methacrylate) is dissolved in the plasticizer with the aid of heat

to facilitate solution. The polyvinyl chloride-acetate copolymer, which should contain over 87% and preferably over 95% of vinyl chloride to retain fluidity over sufficiently long periods of time, is incorporated in the solution until a paste is formed, the dispersion being prepared upon a three-roll ink or paint mill, the copolymer being added until the dispersion has the consistency of rather thick library paste.

The dispersion is poured into the impression and the latter rotated so that the paste is spread into a film over the entire surface of the impression. The paste, upon coming into contact with the hot walls of the impression, gels, forming a relatively thin skin of a flexible plastic material in the negative impression. This plastic skin or positive model is a very accurate reproduction of the model hand used. In practice, from approximately 0.5 per cent to approximately 5% by weight of the polyethyl methacrylate (or polymethyl methacrylate) may be dissolved in the plasticizer, and from 45 per cent to 55 per cent of the plasticizer may be employed. These percentages are per cent by weight of the total composition.

The resulting plastic positive is heated in the impression to toughen it, and then, in order to render this positive rigid, a mixture of sand and wax is poured and vibrated into the cavity within the plastic skin. It will be apparent that the impression of the hand of the model is hollow and open, as is the plastic skin positive. The resulting rigid positive is rendered ready for further treatment by having an electrode bar thrust into the wax-sand mixture to serve as a cathode hanger. The alginate impression compound is removed from the positive, leaving the positive an exact, rigid replica of the original hand. It may be desirable to fill in some of the deeper cracks in order to produce a glove of more uniform thickness and greater strength.

The next step is the production of a mold on this positive. Various methods of making the mold are available, but electroforming is preferred. However, the mold may be prepared by machining, casting, or spraying. Electroforming is preferred, however, as it produces readily a hollow, one-piece metal mold, the interior surface of which is an exact reproduction of the positive on which the metal is deposited.

In order to deposit the metal on the plastic positive surface, this surface must be rendered conductive. This is accomplished by methods well-known in the art, for example, by thoroughly cleaning the surface of the positive, followed by sensitization by immersion in a solution of stannous chloride, and then simultaneously spraying onto the sensitized surface an ammoniacal solution of silver nitrate and a solution of a suitable reducing agent. Preferably, there is added a small quantity of a wetting agent, for example, "Triton 720," which is an aryl-polyether-sodium sulphonate, although such addition is not necessary. Hydrazine sulphate is a satisfactory reducing agent, although many others may be employed, as will be apparent. Actually, the silvering is not an essential step in the overall process, since conductivity may be obtained through the use of graphite, bronze powder, a chemically deposited copper film, and other methods well known in the art.

The electroforming itself is carried out in a manner well known in the art. Preferably, the deposit is controlled so as to be approximately 0.02 to 0.03 inch thick and is entirely of metal.

However, multiple metal molds have been used satisfactorily, for example, molds constructed by depositing approximately 0.005 inch nickel, covering this with approximately 0.02 inch of copper, and depositing on the copper a final coating of about 0.002 inch of nickel. For depositing the nickel, any suitable nickel salt bath that produces a non-porous uniform deposit may be employed, for example, the well known Watt's bath, and the copper from a standard high acid copper bath. The all-chloride nickel bath alternatively may be employed with excellent results, and the various addition agents used in bright nickel electroplating are beneficial for this purpose also. In order to produce a mold of uniform thickness, it is desirable to employ, in addition to the usual anodes in the bath, an auxiliary anode, positioned centrally and approximately one inch from the palm of the hand and in some cases additional auxiliary anodes positioned between the fingers. It is also desirable to "steal" a certain proportion of the current from the fingertips by the use of a cathode screen, situated just off the ends of the tips of the fingers and at a distance from them, of approximately one and one-half inches. The excessively thick deposits normally encountered at edges and corners can be avoided readily in this manner.

Upon completion of the electrodepositing operation, it is only required to remove the wax-sand mixture from within and to pull out the plastic skin. The first operation is performed by boiling the mold until the wax has melted and then draining out the wax and sand. Following this, the flexible plastic skin or glove may be collapsed or withdrawn. In the case of an exceptionally thick skin, small holes may be bored near the tips of the fingers to assist in removal of the plastic material. If desired, the silver may be removed from the interior of the mold at this stage, and the mold cleaned by being dipped into nitric acid, followed by ammonia and water. The mold now is ready for use, and can serve for the production of many thousands of cosmetic gloves. All features of the positive, which was an exact duplication of the original impression of the model hand in the alginate, are exactly duplicated in the mold.

The final cosmetic glove itself is cast from a vinyl chloride polymer or copolymer. In practice, there are employed polymers or copolymers containing between 95 per cent and 100 per cent vinyl chloride, the remainder being vinyl acetate, methyl methacrylate, methyl acrylate, ethyl acrylate, diethyl-maleate, or other well known vinyl compounds. Two such materials commercially available are known to the trade as "Vinylite VYNV-2" and "Geon 100 x 210," the former of which is a copolymer of vinyl chloride with small percentages of vinyl acetate, the latter being essentially polyvinyl chloride. These vinyl resins are identified still more particularly in Patent No. 2,562,204, issued July 31, 1951, to the present applicants (see page 1, column 2, lines 26 through 32 of the patent), while the original alginate impression materials are identified and described more particularly in Patent No. 2,538,160, issued January 16, 1951, also to the present applicants (see page 2, column 4, lines 19 through 60). In the making of the glove, there is employed a grade of polymer the characteristics of which are such that a dispersion consisting of fifty per cent polymer and fifty per cent di-2-ethyl-hexyl phthalate as plasticizer for the polymer has a viscosity of less than fifty

thousand centipoises. A dispersion of a resin of this type is made in a suitable plasticizer, together with stabilizing agents and pigments as required An illustrative, suitable composition is:

Resin_____parts by weight__	50
Plasticizer (di-2-ethyl-hexyl phthalate or a mixture of di-2-ethyl-hexyl phthalate and a polymer of low molecular weight) _parts__	50
Stabilizer (basic lead silicate, strontium resinate, dibutyl tindilaurate, or mixture of the same) _____parts__	4

This composition has the viscosity of a rather thin library paste, and it can be poured with ease. The procedure consists in deaerating the paste by the application of vacuum, and pouring it into a mold, the preparation of which has been described above. An additional deaerating step may be carried out at this point, if desired or the paste may be poured out, leaving only a film, a vacuum applied and the mold refilled with paste. Mechanical vibration is useful during the filling operation. The mold next is heated to the boiling point of water for a period of from five to forty-five seconds, depending upon the speed of gelation of the particular compound employed. At the end of this period, the mold is chilled, and the paste is drained from it as thoroughly as is possible at room temperature. The mold subsequently is drained first at 65° C. and then at 90° C. for a typical compound. Drainage of the liquid paste is nearly complete, almost all of the plastic left in the mold being that which gelled upon application of the heat. Gelation of the balance may be effected by transferring the drained mold in an inverted position to an oven at 300° F. for a few minutes.

At this stage the plastic is entirely too weak for use as a glove, and its physical properties can be improved only slightly by prolonged exposure at temperatures in the neighborhood of 100° C. In order to develop the ultimate strength of the material, exposure to a much higher temperature is necessary. For this purpose a temperature of substantially 380° F. is preferred, although the optimum temperature for this final treatment may vary between 320° F. and 420° F. This treatment may be effected conveniently by immersing the mold in a pot of oil or glycerine maintained at the desired temperature. For a nickel mold 0.02 inch thick, a time immersion of approximately four minutes usually is satisfactory.

An alternate procedure is to conduct the heating at about 380° F., in a circulating air oven for approximately five minutes, followed by an immersion for three minutes in the heat transfer liquid.

Upon being cooled, a thin glove, the thickness of which was determined by the time of gelation at 100° C., is removed from the mold. The mold is in a single piece, and is a negative of the glove. The cosmetic glove which is formed is an excellent duplicate of the hand of the model, accurate in shape, and exquisite in skin detail. It does not require being reversed after the fashion of gloves made on dipping forms.

The final step consists in coloring the glove. It will be apparent that the basic colors are incorporated in the resin paste compound. What remains is to color the veins, the finger nails, the knuckles, and to break up the monotony of the color over the entire surface. This may be done by allowing soluble colors to diffuse into the deposited resin, but preferably it is done by using insoluble colors which cannot subsequently migrate in service.

To this end, the glove conveniently is turned inside out, and pigments, which have been ground into a solution of the same resinous composition of which the glove is made, are applied. An equally effective method is to grind the pigment into the resin-plasticizer mixture employed, place this upon the surface as required, and seal the color to the surface by the application of a good solvent such as cyclohexanone or a solution of the resin in cyclohexanone. Small amounts of acetone, methylethyl ketone, methylene chloride, or propylene oxide may be added to increase the "bite" of the solution or solvent. In this way, the added color is caused to adhere to the glove proper and is covered with a layer of plastic material which prevents its being rubbed off. It is to be noted that the color is underneath the glove rather than on top so that very little abrasive action is encountered in service. If desired, natural hair or nylon threads, or other synthetic fiber, dyed to the desired shade, may be inserted by means of crochet needles or hooks, hollow needles and the like. In this way, a most life-like appearance is achieved.

The accompanying drawings represent the improved cosmetic glove of this invention,

Fig. 1 showing a side view of the glove;

Fig. 2 a back view of the glove; and

Fig. 3 showing a section through the back of the glove taken on the line III—III of Fig. 2.

Referring more particularly to the drawings, the glove as shown comprises the hand portion 5, open wrist portion 7, and fingers 9. The hand portion 5 is shown as being provided with veins 11, and the fingers with the nail portions 13. Filaments 15, representing hairs, are provided. The veins, nails, lines on the fingers and joints are imparted to the glove during the molding and all details are exact replicas of the original hand. The resin composition of which the glove is composed is of itself a close approximation of the natural skin, and transmits sufficient light so that the interiorly-applied pigmentation shows through just enough to impart an extremely life-like appearance to the glove.

From the foregoing, it will be seen that the gloves of this invention are seamless and are made of a plasticized compound based on a polymer or copolymer of vinyl chloride, such as "Vinylite VYNV–2" or "Geon 100 x 210" above identified. These resins differ from most vinyl chloride polymers in that, when they are ground (in the first case) or mixed (in the second) with a plasticizer, they form fluid dispersions. Coloring materials and stabilizers may be added to the pastes as desired.

On being heated to from 85° C. to 100° C., these dispersions gel. On being heated further to about 170° C. to about 220° C., the weak initial gels fuse and on cooling exhibit the requisite tensile strength, tear and abrasion-resistance for the production of cosmetic gloves of satisfactory physical properties as well as appearance.

As has been indicated above, the process of the invention comprises filling the mold with the resin-plasticizer paste, dipping the mold into water maintained a little below the boiling point for a short period of time (about twenty seconds) and pouring out the material in the center which did not become hot enough to gel.

Auxiliary layers of color to achieve a life-like

appearance are deposited by pouring colored paste into the gelled "skin" in the mold and draining out again without an intermediate gelling step. To break up the color, a dauber on the end of a stick or probe is rubbed around inside the mold. The thin, broken-up deposit which adheres thereto is gelled before additional paste is applied.

When a suitable number of layers of color have been applied and gelled, the entire deposit is fused by immersing the mold in a suitable heat transfer medium.

The highlights, veins, nails, etc., may be colored in one or more of three ways:

1. By applying to the deposit a suitably colored paste on a probe at any stage in the process prior to final fusion.

2. By dispersing insoluble colors in a resin solvent such as cyclohexanone or a plasticizer, and applying them to either side of the glove following fusion.

3. By dispersing soluble colors in a non-solvent and applying them to the outside of the glove.

However, as is indicated above, the color preferably is applied interiorly of the glove, and becomes visible by light transmitted through the resin body of the glove.

Having thus described our invention, what we claim and wish to secure by Letters Patent is:

1. A cosmetic glove adapted to cover an artificial hand, comprising a flesh-colored, flexible, pliable and stabilized plasticized vinyl chloride polymer, the polymer containing at least approximately 95% of vinyl chloride, the glove being seamless and reproducing veins and all surface characteristics of a natural model hand, the glove having its interior surfaces pigmented to reproduce by means of color showing through the glove the coloring of a natural model hand.

2. A cosmetic glove adapted to cover an artificial hand, comprising a plasticized, flesh-colored, flexible, pliable and stabilized vinyl chloride polymer, the polymer containing at least approximately 95% of vinyl chloride, the glove reproducing veins and all surface characteristics of a natural hand, the glove being thin-walled, seamless and having its interior surfaces pigmented to reproduce by means of color showing through the glove the lines of a natural model hand, and filaments distributed over back areas of the glove and anchored in the resin to reproduce the appearance of hairs on the natural model hand.

3. A cosmetic glove adapted to cover an artificial hand, comprising a plasticized, flesh-colored, flexible, pliable and stabilized vinyl chloride polymer, the polymer containing at least approximately 95% of vinyl chloride, raised back portions of the glove duplicating natural veins in a natural model hand, the glove being seamless and duplicating all other surface characteristics of the natural model hand, pigmentation on the inner surfaces of the glove imparting natural flesh tints to the glove when viewed in light transmitted through the glove, the raised back portions being interiorly colored to duplicate the appearance of natural veins when viewed in light transmitted through the glove, and filaments distributed over back areas of the glove and anchored in the rear thereof to reproduce the appearance of natural hairs on the natural model hand.

4. A cosmetic glove adapted to cover an artificial hand, comprising a plasticized, flesh-colored, flexible, pliable and stabilized vinyl chloride polymer, the polymer containing at least approximately 95% of vinyl chloride, the glove being interiorly pigmented on inner surfaces thereof, the pigments showing through the glove sufficiently to duplicate the coloring of a natural model hand, the said glove including fingers, knuckles, finger-nail portions, finger and palm lines, and vein portions, the said glove duplicating in appearance all surface details of the natural model hand, the glove being characterized by high toughness and tear-resistance.

5. A sheath-like cosmetic glove for covering an artificial hand and which reproduces in high fidelity the appearance and surface details of a natural model hand, the said glove being seamless and being provided with an interior pigmented coating for imparting to the glove a coloration substantially identical to that of an amputee wearer's normal human hand, the said glove being of a thinness adapted to permit visual perception of the pigmented coating when viewed through the entire thickness of the glove from the anterior surface thereof and being composed of a plasticized vinyl chloride polymer containing between 95% and 100% vinyl chloride to provide and maintain a skin-like texture.

CLARE L. MILTON, JR.
CARL A. NIELSON.

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